ORIGINAL ARTICLES

PRIMARY CARCINOMA OF THE LUNG: THE IMPORTANCE OF EARLY DIAGNOSIS IN INCREASING OPERABILITY AND CURABILITY*

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PRIMARY cancer of the lung is no longer a pathologic curiosity. Reliable statistical studies, covering many thousands of autopsies, have shown that bronchiogenic malignancy now comprises approximately 10 per cent of all carcinomas.[1] We are, then, dealing with a lesion which is relatively common and in which an early diagnosis must be made if a cure is to be expected. At present, wide surgical removal by pneumonectomy is our most certain means of cure. Awareness of the frequency of primary carcinoma of the lung must warn the physician to search for confirmatory evidence whenever an unexplained thoracic symptom-complex is presented. This report concerns early symptomatology, and outlines the further diagnostic procedures which are necessary when bronchiogenic carcinoma is suspected.

* Read before the Section on General Surgery of the California Medical Association at the sixty-ninth annual session, Coronado, May 6-9, 1940.

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SYMPTOMS AND SIGNS

Persistent cough is an early symptom in nearly all cases. At first it is nonproductive and hacking in character. When sputum first appears it is usually mucoid, later becoming purulent when infection has developed beyond an obstructing neoplasm. Wheezing due to the partial obstruction of a large bronchus is frequently a prominent symptom. Blood-streaking in the sputum may occur early in the disease, but its complete absence is not unusual. Large hemoptyses are uncommon except as a late development.

Many patients attribute their difficulties to a cold, to influenza, or to a pneumonia which did not clear up properly. The persistence of fever, night sweats, and productive cough for many weeks, following an acute respiratory episode, should be regarded with great suspicion. Unless the history is properly evaluated, symptoms of continuing or recurrent pulmonary infection may entirely overshadow the evidence of an obstructing neoplasm. In such patients, pulmonary tuberculosis and other chronic infectious diseases may be readily ruled out by adequate sputum examination.

Occasionally patients with a chronic cough, due to bronchitis or bronchiectasis, note a change in the cough. There may be an alteration in tone, and the cough becomes more irritating. The sputum changes character and there may be blood-streaking. This change in "cough habit" should be regarded with exactly the same suspicion as one regards a change in bowel habit when a carcinoma of the colon is suspected.

Thoracic discomfort often occurs due to atelectasis, pulmonary infection, or pleural irritation. Constant severe chest pain is uncommon as an early

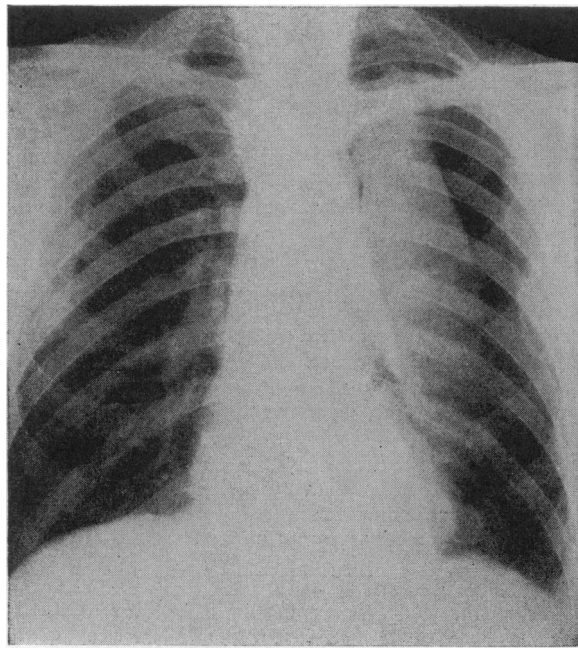


Fig. 1

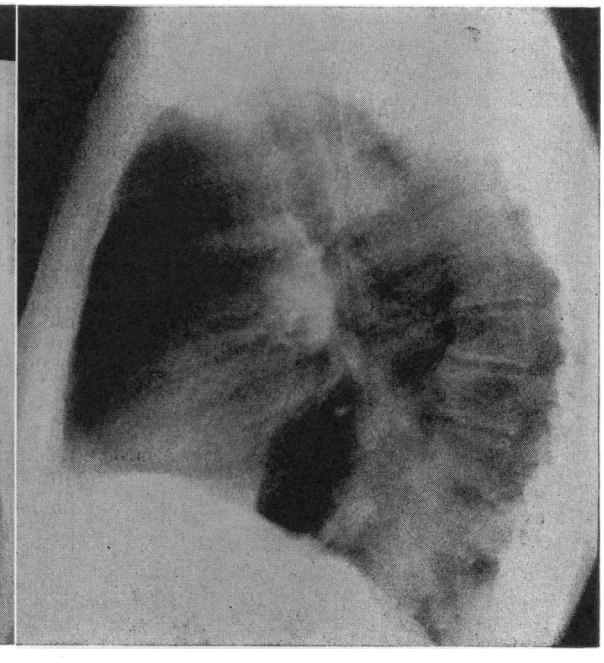
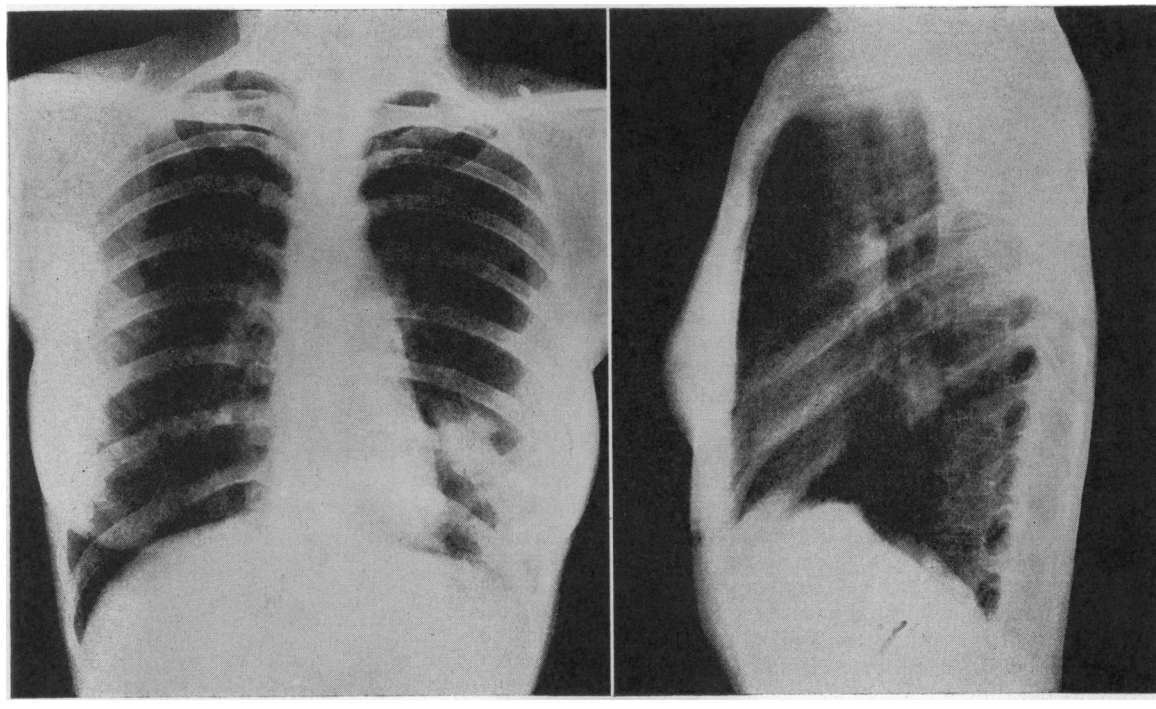


Fig. 2

* Fig. 1.—Complete obstructive atelectasis of left upper lobe. Preoperative pneumothorax present. (Case 1.)
* Fig. 2.—Wedge-shaped lobular infiltration in left lower lobe, lateral projection. (Case 2.)

* Figs. 1, 2, and 3 reprinted from *Western Journal of Surgery, Obstetrics and Gynecology.*



* Fig. 3.—Frontal and lateral projections showing rounded density in left lower lobe (Case 4). Biopsy secured by careful nonvisual exploration of successive tertiary bronchi.

symptom. Moderate weight loss and slight anemia may be present. In the face of other suggestive findings, age should not be taken into consideration, since carcinomas of the lung have been reported in patients under twenty.

There are no characteristic objective findings in early pulmonary cancer. Physical signs may be entirely absent. Occasionally a small neoplasm may cause a total atelectasis with resultant cardiac and mediastinal shift. Localized wheezing and coarse rhonchi are of importance when present. The development of nerve palsies (Horner's syndrome, recurrent laryngeal and phrenic paralysis), vascular obstruction, or esophageal deviation usually indicate that the neoplasm is inoperable.

DIAGNOSIS

When a bronchiogenic neoplasm is suspected, adequate roentgen examination must be the first step in diagnosis. This should consist of fluoroscopy, followed by frontal stereoscopic and lateral films. The chief value of fluoroscopy is to determine whether or not an obstructive emphysema is present. Adequate film studies are necessary for accurate localization. Many neoplasms do not present a characteristic picture because of obscuring parenchymal infection.[2] Irregularly rounded shadows, with faint peripheral radial striations, may be seen. Persistent wedge-shaped lobular infiltrations should be regarded with suspicion. Lobar atelectasis is not uncommon (Figures 1-4). Occasionally the roentgenogram reveals no evidence of disease. If symptoms persist, however, further diagnostic procedures should be carried out.

Bronchoscopy, with biopsy, probably is the most important single procedure which we possess for the determination both of diagnosis and of operability. This examination always should be advised without hesitation. In competent hands the hazard and discomfort are minimal.

As with other diagnostic procedures, bronchoscopy is not infallible. Microscopic examination of tissue may not substantiate the visual impression of tumor. In this case bronchoscopy should be repeated immediately. Should the first examination fail to reveal neoplasm, and should suspicious symp-

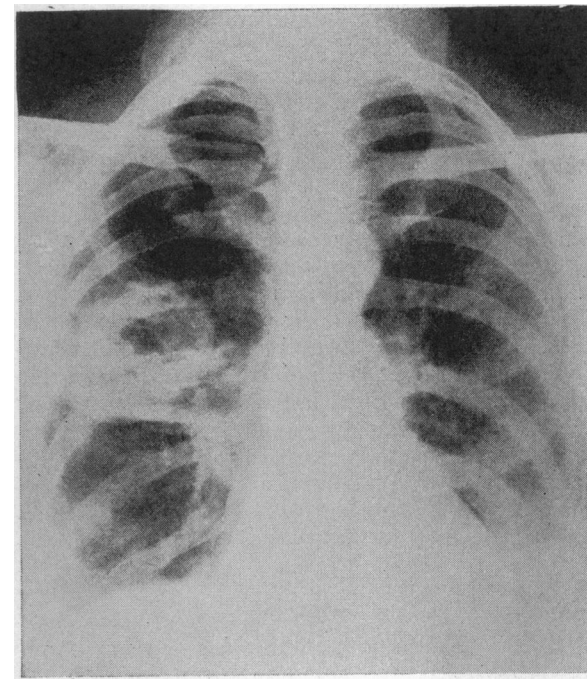


Fig. 4.—Large, irregular cavity in right upper lobe. Walls unusually thickened. "Excavating carcinoma." Preoperative pneumothorax present. (Case 6.)

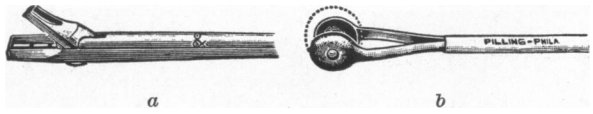


Fig. 5.—Biopsy instruments most frequently used. (*a*) Square-end basket forceps with cutting edge. (*b*) Sharp-edge cup forceps, extremely useful for probing smaller bronchi beyond bronchoscopic vision. In such instances biopsy material is secured by a scalping technique rather than by biting.

toms continue, a second bronchoscopy within a few weeks is imperative. In approximately 75 per cent of cases a definite diagnosis will be established bronchoscopically. The careful study of prebronchoscopic roentgenograms may be of great aid if the lesion is not visualized at bronchoscopy. Accurate roentgen localization often permits successful "blind biopsy" with curette or cup-forceps (Figure 5). Holinger[3] has used biplane fluoroscopy for the same purpose, but this apparatus is seldom available. In rare instances the induction of pneumothorax causes sufficient downward bronchial angulation to permit visualization of an otherwise inaccessible lesion. If the suspected neoplasm is not visualized, but blood-streaked sputum is seen, this should be collected in a separate container, fixed, and paraffin sections made.

Bronchoscopy, likewise, gives valuable aid in judging as to the possibility of pneumonectomy. The thoracic surgeon should be able to perform his own bronchoscopies and to decide for himself the question of operability.[4] The presence or absence of carinal fixation, the distance of the visualized neoplasm from the carina, and the presence of proximal submucosal extension, are all important factors in making a decision.

Of considerable benefit from the operative standpoint is the great subjective improvement which often follows bronchoscopy. If the neoplasm causes obstruction, it has been our practice carefully to remove obstructing tissue, dilate the bronchus, and aspirate all secretions. The decreased cough and sputum, loss of fever, and improvement in appetite are valuable aids in the preparation of a patient for operation.

Other less frequently used methods of diagnosis in early bronchiogenic carcinoma may be summarized briefly. None of these, however, should replace roentgenographic study or bronchoscopy. Dudgeon[5] has perfected a "wet-film" technique for the study of neoplastic fragments in fresh sputum. Transthoracic aspiration biopsy in peripheral neoplasms has been employed by Craver and Binkley[6] with success. But the indiscriminate use of this method is not justified because of the dangers of infection and of implantation metastasis. The verification of peripheral neoplasms also may be obtained by thoracoscopic inspection following induction of pneumothorax. Bronchograms which show bronchial defects on *repeated* examinations may be of value.

AUTHORS' SERIES

Six total pneumonectomies for primary carcinoma of the lung have been performed by the writers, with postoperative recovery in four patients. In neither fatal case was death due to operative shock. These two patients survived eleven and twenty-four days, with death resulting from purulent pericarditis and empyema, respectively. It is of interest that in both fatal cases the pneumonectomy was right-sided. It is our impression that adequate closure of the stem bronchus is more difficult on the right, due to the relatively higher origin of the right upper lobar bronchus. In addition, mediastinal shift to the right, and compensatory hypertrophy of the left lung, do not take place as easily as do the corresponding mechanisms for obliteration of the left pleural cavity.

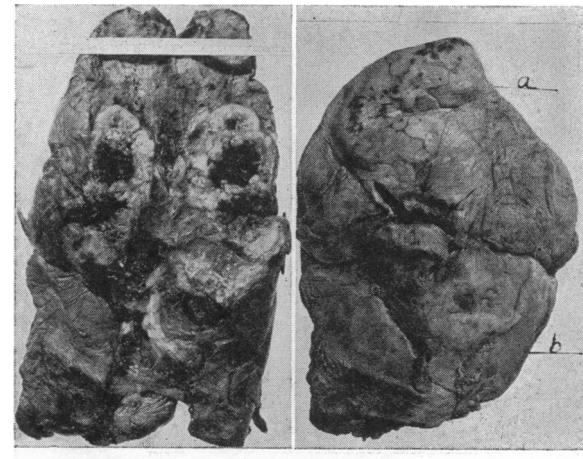


Fig. 6.—Right lung. Operative specimen from Case 6. (*A*) Outer surface: (*a*) upper lobe; (*b*) middle lobe. Arrows point to the carcinoma which arises in the upper lobe, but which encroaches on both main and accessory fissures. This specimen demonstrates the futility of attempting lobectomy even in cases of peripherally-situated carcinomas. (*B*) Longitudinal section. The central portion of the carcinoma became necrotic and has excavated (see Fig. 4).

A summary of the six cases follows. Details of the histories and operative technique have been presented elsewhere.[7]

REPORT OF CASES

CASE 1.—A white male, aged 62, complained of productive cough, weakness, and loss of weight for a period of three months. Roentgenograms showed atelectasis of the left upper lobe. Bronchoscopy showed occlusion of the left upper lobar bronchus, as though from external pressure. No biopsy was procured. Pneumonectomy was performed by mass ligation and the pleural cavity was drained. Bronchiogenic carcinoma was verified microscopically. The patient died suddenly from coronary thrombosis one year following operation. There was no evidence of recurrence. He had been working for many months prior to his death.

* * *

CASE 2.—A white male of 63 years had a five months' history of recurring fever, pleurisy, productive cough, and blood-streaking. The original diagnosis was pneumonia. Roentgenograms showed a wedge-shaped infiltration of the left lower lobe. Bronchoscopic biopsy was confirmatory of primary carcinoma of the lung. Pneumonectomy was performed and the patient made an uneventful recovery.

* * *

CASE 3.—A white male of 36 years had a nine months' history of paroxysmal productive cough, blood-streaking, wheezing, weakness, and loss of weight. Roentgenograms showed a dense, rounded mass in the left lower lobe. The diagnosis was confirmed bronchoscopically. Pneumonectomy was performed successfully. The hilar lymph nodes showed metastases. The patient was relatively well for

four months, but died eight months after operation with symptoms of cerebral metastases.

* * *

CASE 4.—A white female of 32 years had a six weeks' history of nonproductive cough and slight loss of weight. Initially, there was severe left-sided pleurisy. Roentgenograms showed a small rounded mass in the left lower lobe. No tumor was visualized bronchoscopically. "Blind biopsy" with cup forceps and curette, however, was productive of neoplastic tissue. Pneumonectomy was performed successfully. Later, rib resection was necessary for a localized empyema. Convalescence is progressing, although thoracoplasty may be necessary because of persistent left-sided thoracic pain.

* * *

CASE 5.—A white male of 54 developed a "cold," which did not subside. There was an eight months' history of productive cough, with blood-streaking, night sweats, loss of weight, and pain in the right upper thorax. Roentgenograms showed atelectasis of the right upper lobe, and bronchoscopy confirmed the presence of a neoplasm blocking the upper lobar bronchus. During pneumonectomy the pleural cavity was grossly contaminated. Intercoastal drainage was provided. Following an initial period of recovery, the patient died suddenly on the eleventh postoperative day. At autopsy, an acute purulent pericarditis was discovered.

* * *

CASE 6.—Seven months prior to operation a white female of 61 years began bringing up, almost without effort, blood-streaked purulent material. The onset was insidious. Slight cough later developed, with associated ease of fatigue and loss of weight. There had been a long-standing history of asthma. Roentgenograms showed a large, irregular cavity with greatly thickened walls lying peripherally in the right upper lobe. The white blood count was 11,300. Bronchoscopy did not reveal neoplasm. In the differential diagnosis, pulmonary abscess was ruled out because the patient was not ill enough, and because the roentgenograms were not characteristic. The lung was removed and on section a carcinoma with necrotic center was found (Fig. 6). Putrid empyema developed and the patient died twenty-four days following pneumonectomy.

SUMMARY AND CONCLUSIONS

At present any expectation for cure in primary cancer of the lung lies with radical resection, preferably by pneumonectomy. In the seven years which have elapsed since Graham[8] first successfully removed a lung for carcinoma, great strides have been made in reducing the operative mortality. Several patients already have survived total pneumonectomy for five years or longer without evidence of recurrence.

As with carcinoma elsewhere in the body, early diagnosis is paramount if surgery is to be effective. With this thought in mind we have detailed the various early symptoms which should suggest the possibility of bronchiogenic cancer. We wish to emphasize again that thorough roentgen studies and bronchoscopy are invaluable procedures in establishing a diagnosis.

Brief histories have been given of six patients who underwent total pneumonectomy. In this group, four patients recovered from operation.

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IMMEDIATE MANAGEMENT OF SURFACE INJURIES*

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TO avoid repetition and to give a clearer concept of the immediate management of surface injuries, I have elected to divide the treatment into (1) general considerations and (2) specific procedures directed to certain local areas.

The optimum time to see and start appropriate treatment for any surface injury is as soon as possible after the injury has occurred. This is elementary, and should be a foregone conclusion with men handling these cases; but too often there are instances where hours of delay have intervened through no fault of the patient, the injury being attended to at the convenience of the attending surgeon. Every moment's delay jeopardizes the possibility of a good end-result and, naturally, increases the incident of infection. Perforations of the body covering should be given the same prompt attention that the surgeon knows, from experience, he must give perforations of the viscera. The longer the delay the more likely are complications.

If the injury is of any import, it should not be looked on as an office procedure, but the patient should be given all the advantages of the modern hospital. This is such a well-known fact that experienced insurance companies will insist that hospital entry be effected immediately after they have been notified.

Primary hemorrhage occurring as the result of the injury must be stopped, and shock should be combated to the fullest extent to improve the patient's general condition as well as to speed local healing.

CHOICE OF ANESTHETIC

The choice of the necessary anesthesia lies with the attending surgeon. I prefer local (1 per cent novocain) as a block or distal infiltration anesthesia where possible; otherwise, gas or ether inhalation, as indicated. For extensive hand injuries involving tendons or nerves, gas anesthesia is satisfactory.

* Read before the Section on General Surgery at the sixty-ninth annual session of the California Medical Association, Coronado, May 6-9, 1940.